

# **Ecotect: As Part of the Learning Experience for Young Architecture Students to Raise Awareness in Environmental Responsive Building Design.**

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## **Abstract**

This study investigates the feasibility of introducing environmental analysis software called Ecotect to final year LAM Part 1 Architecture students in the International Islamic University Malaysia (IIUM). The study evaluates the students' response and perception towards the software after completing the environmental analysis assignment. The assignment was given during the Environmental Conscious Design course and the students were required to conduct natural daylight analysis and average indoor thermal analysis of their studio design project using the Ecotect software. A student feedback survey on the Ecotect assignment was conducted among 64 students. Rather positive feedbacks were obtained from the students. In overall, 72% students were fully satisfied and 22% students were neutral with the Ecotect Assignment. However, 89% of the students agreed for the assignment to remain within the Environmental Conscious Design course since they had benefitted from the exercise. Majority of the students suggested the assignment to be introduced at earlier stage. Based on the high percentage of positive feedbacks from the IIUM architecture students, the teaching and exercise of Ecotect should be extended to more students and a brief introduction of such software to students in the 1<sup>st</sup> year of LAM Part 1 Architectural Studies could make the learning experience more effective.

**Keywords:** Ecotect, Integration, Environmental Design, computer simulation.

## **Introduction**

In the Department of Architecture in IIUM, students normally attend lectures and in conjunction with that, they are given studio design projects to apply what they were taught in the same semester. However, it is often the case that students did not manage to inject the information fed to them during lectures, onto their studio design project. Evidently, their design work mostly complied with the concept, building type and space requirement written in the design project brief. However, the students often lack in producing environmental responsive building design. Therefore, the Ecotect assignment was given to students within the Environmental Conscious Design course, with the intention of integrating the course assignment with their studio design project. This was intended to also introduce Autodesk Ecotect as sustainable analysis software, including its range of simulation. This study then looks into the response and perception of architecture undergraduate students towards the Ecotect assignment, after completing the proposed assignment. In overall, this study was carried out to review wider learning issues (beyond IIUM) with regards to the students' deficiency in producing environmental responsive building design.

## **Literature Review**

It was not the Department of Architecture's first attempt in engaging young architecture students into testing their studio design project with environmental

simulation software. It has been done in 2006 but there is no proper survey on the significance of the exercise on the students' progress. However, an interview session with the former Head of Department back in 2006 was conducted on the students' perception towards the environmental simulation assignment. It was concluded that the students were very much receptive on having the opportunity to explore environmental software within the Environmental Conscious Design course back in 2006 under the guidance of Assistant Professor Dr. Puteri Shireen Jahn Kassim (Zuraini, 2012). During the course, the students were given a demonstration of the environmental software once and then, followed by close guidance by three senior students whom have been trained using the software. Unfortunately, such exercise has not been repeated in a regular basis until the Ecotect assignment this year.

The Ecotect software was developed by Dr. Andrew Marsh as part of his PhD thesis in the University of Western Australia (Thoo, 2007). It is a very useful tool for architects to test the environmental impact on their design scheme even at an early design stage (Thoo, 2007). In 2001, integration of Ecotect into the learning experience was evaluated among undergraduate students in the Welsh School of Architecture. 43 students responded to the survey questionnaire on their overall perception towards this integration and 85% of them agreed or strongly agreed on the integration of Ecotect into their learning experience (Marsh and Roberts, 2001). In Egypt, the integration of Ecotect daylighting simulation software in architectural education was successful. 70% of the students found it to be "powerful" and "very useful", whereas, 85% of the students found the software as user-friendly (Sabry et al., 2010). By introducing such building performance simulation (BPS) early, the design process usually delivers interesting results, reflecting students' critical understanding of how the buildings work (Charles and Thomas, 2009).

### **Research Objective**

The issue with regard to the students' deficiency in producing environmental responsive building design is the rationale behind the three main objectives for this study, which are listed below:

- To investigate the students' overall perception towards the Ecotect assignment as a method of integrating the Environmental Conscious Design course with the studio design project.
- To evaluate the significance of the Ecotect assignment on the students' studio design project.
- To enquire the potential of maintaining the Ecotect assignment within the course in the future.

### **Methodology**

The 3<sup>rd</sup> year students of LAM Part 1 Architecture were introduced to the Ecotect software and they were required to complete an assignment within 4 weeks. The assignment was given near to the end of the Semester and it comprises of natural lighting and thermal analysis of an indoor zone, selected from their studio design project building. Each student was required to submit the Ecotect assignment in a poster form that should contain the Floor Plan of the building showing the location of the selected zone, Shadow Casting onto the analysed zone, natural lighting and thermal analysis results in graph form, and the design synthesis which were to be

concluded from the result. After completing the Ecotext assignment, a student feedback survey was conducted where each student was given a set of questionnaires. The questionnaires enquired their perception on the adequacy of the time given, the significance of Ecotect assignment to their studio design project and their suggestions for future improvement. 64 students completed the feedback survey questionnaires.

## Results and Analysis

The students presented their Ecotect assignment in a poster during their studio design project final presentation assessment. The following figures are extracted from some of the best posters examples among the posters presented by the students.

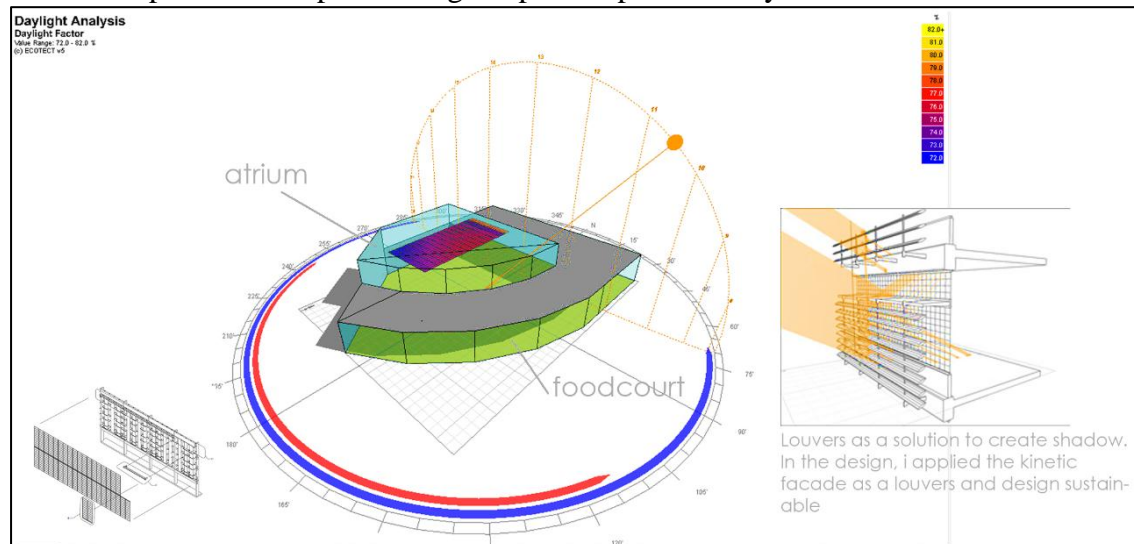


Figure 1: Comprehensive Daylight Analysis using Ecotect software and design synthesis (Source: Mohd Fariq Adnan, Semester 2, 3<sup>rd</sup> year, 2011/2012)

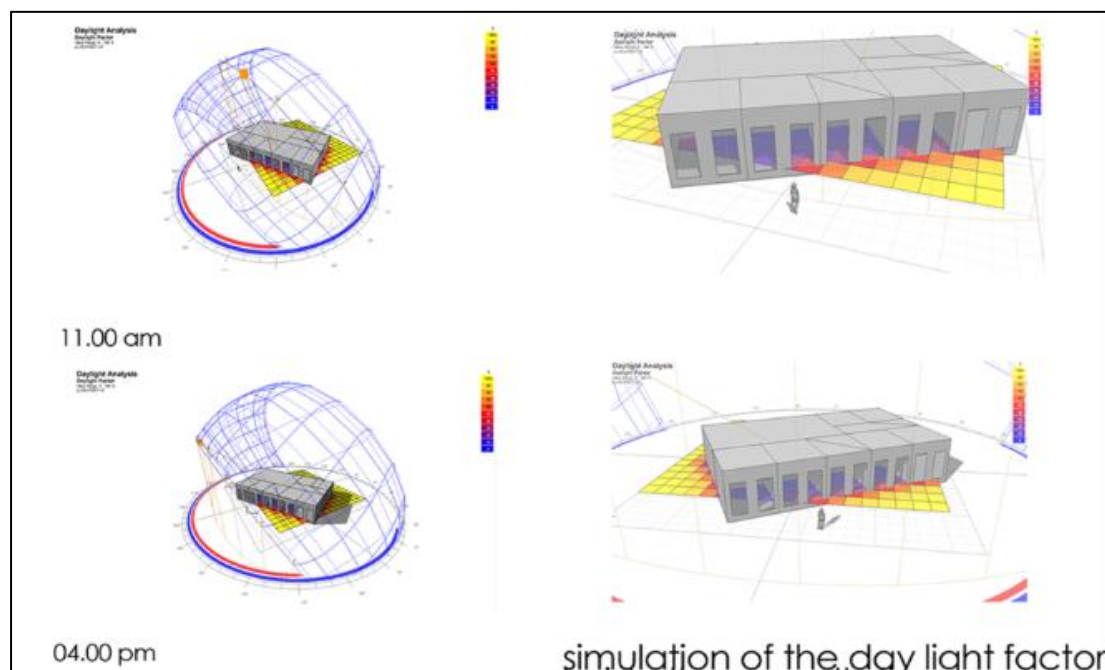


Figure 2: Daylight Factor of a selected zone using Ecotect software (Source: Mohd Shahrul Aizat bin Shahri, Semester 2, 3<sup>rd</sup> year, 2011/2012)

Figure 1 shows a section of a student's poster board that shows rather comprehensive Daylight Analysis using Ecotect software with projection of 24 hours sun angles of one particular day in Kuala Lumpur. The poster was completed with a design synthesis on how to solve the issues of excessive glare from natural daylight.

Figure 2 presents a section of a student's poster board that shows rather Daylight Analysis with daylight factors using Ecotect software with projection of annual sun angles in Bangladesh.

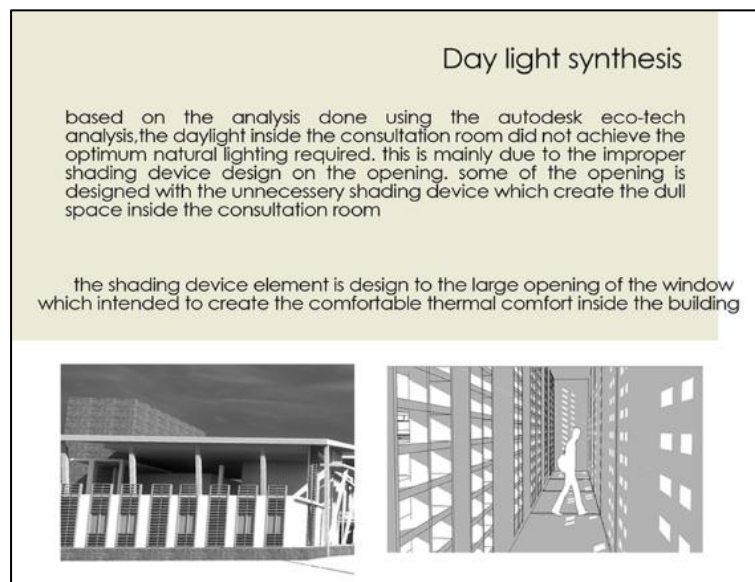


Figure 3: Design synthesis responding to the penetration of natural daylight (Source: Mohd Shahrul Aizat bin Shahri, Semester 2, 3<sup>rd</sup> year, 2011/2012).

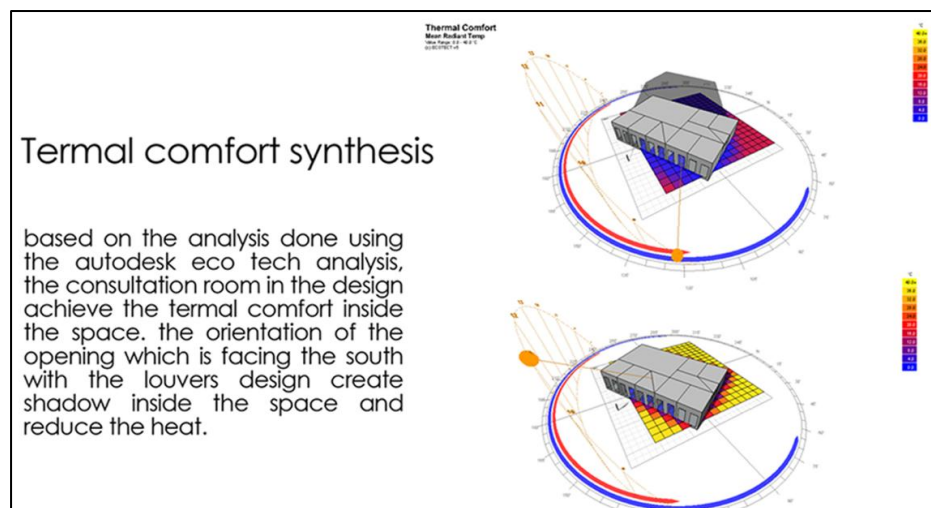


Figure 4: Thermal Comfort Analysis and Design synthesis for thermal comfort (Source: Mohd Shahrul Aizat bin Shahri, Semester 2, 3<sup>rd</sup> year, 2011/2012).

Figure 3 reflects the maturity of the students critical thinking after analysing his building with the Ecotect software and realising the importance of environmental responsive design approach to create a functional indoor space. Meanwhile, Figure 4 presents both the thermal comfort analysis and its design synthesis, which responded to the thermal comfort results.

As mentioned before, after the students completed and submitted their posters, they were given a set of student feedback survey questionnaires. The results from the survey were rather positive (Figure 5 and 6).

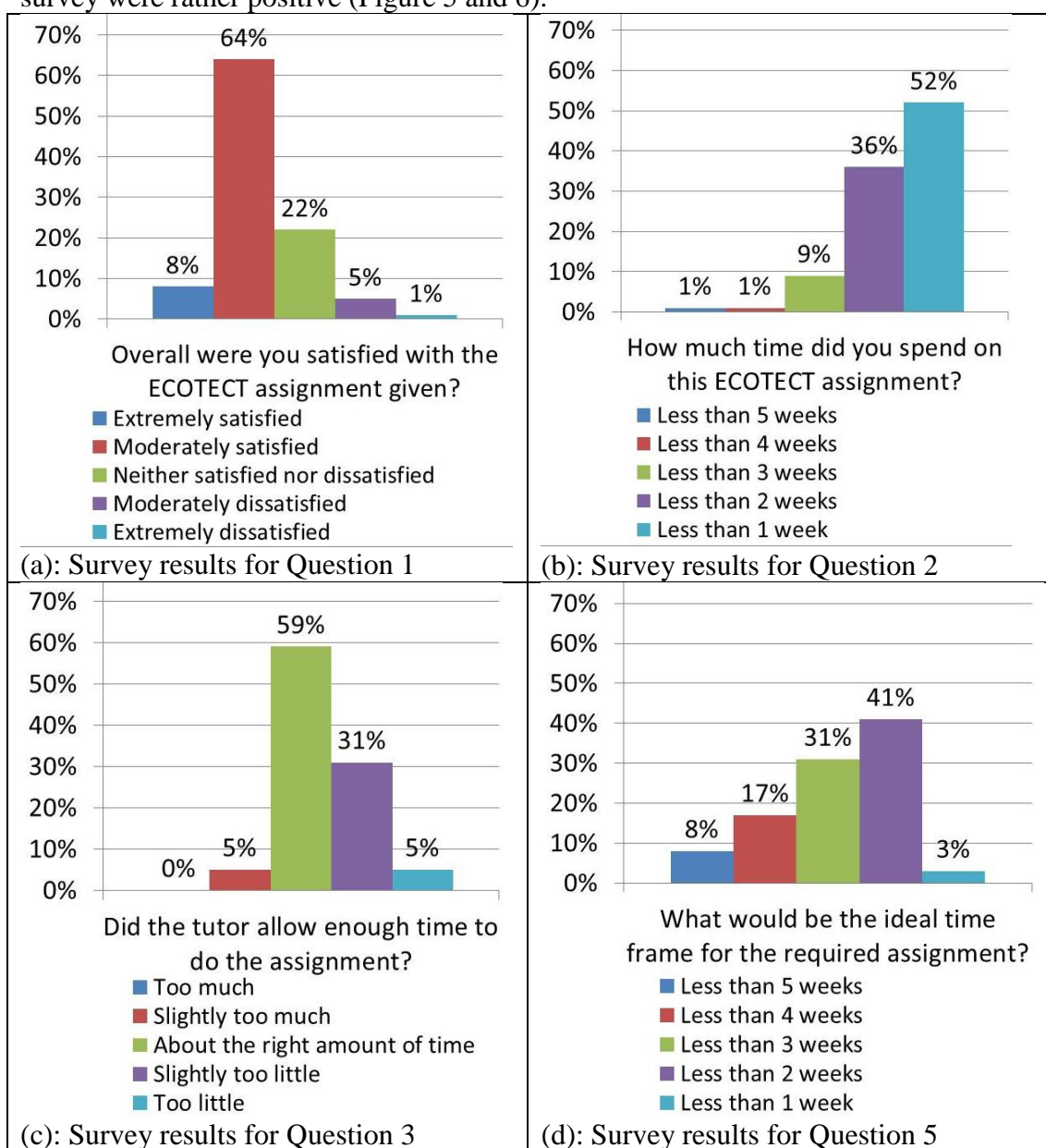


Figure 5: Results obtained from the students' feedback survey in overall of the Ecotect assignment and on the time-scale given to complete the assignment.

Figure 5(a), (b), (c) and (d) present the results obtained from the students' feedback survey on the Ecotect assignment in overall and on the time-scale given to complete the assignment. Figure 5(a) shows that in overall, 72% of the students find it either extremely or moderately satisfied. There were only 6% of the students find the assignment not satisfied. Meanwhile, 22% of the students were sitting on the fence. The uncertain 22% of the students was partly because they are not satisfied with the timing when the assignment was given but however found the assignment valuable (Figure 5(c)). Figure 5(c) shows there are 36% of the students have found the time given to do the assignment was either slightly too little or too little.



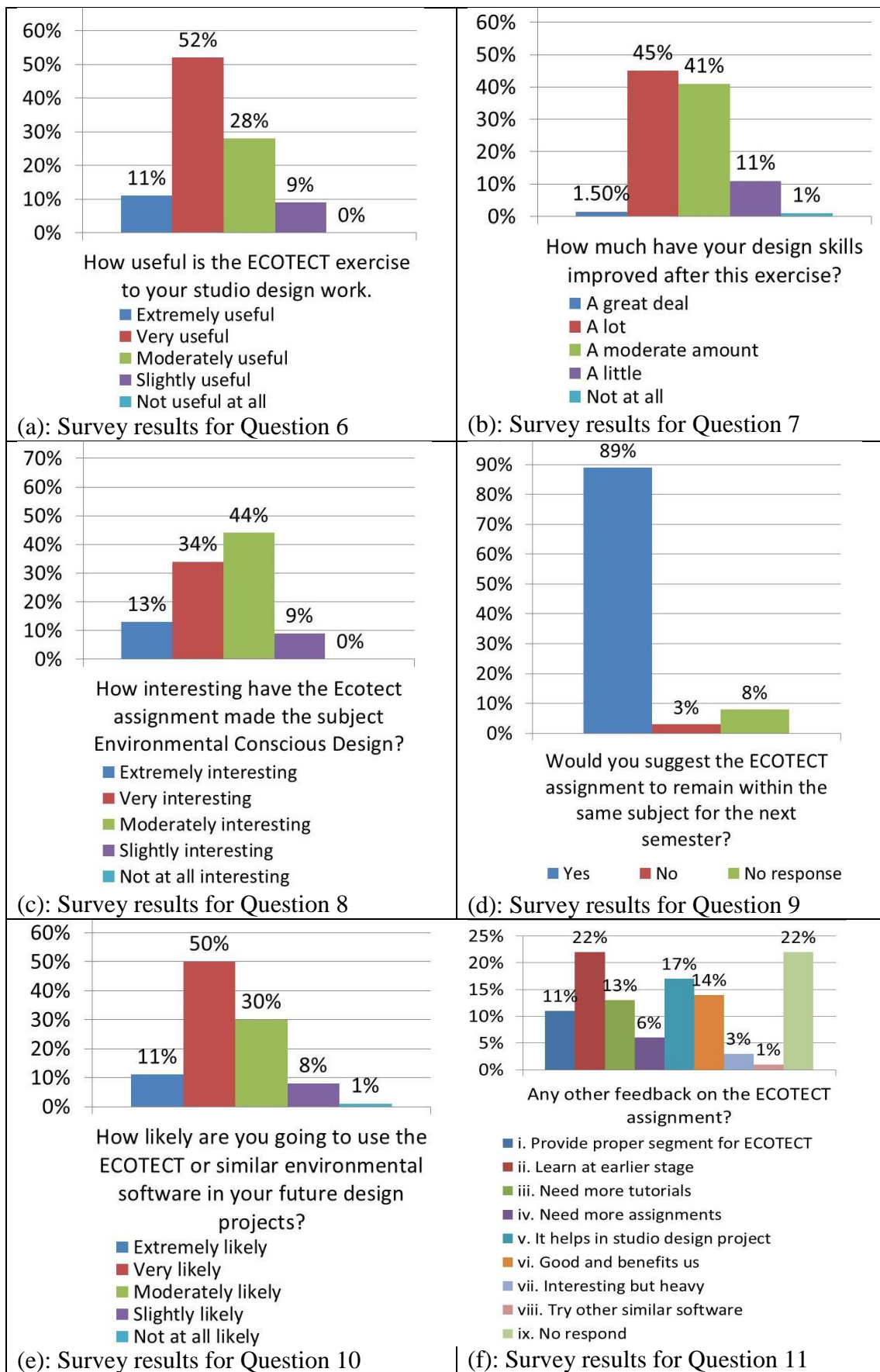


Figure 6: Results obtained from students' feedback survey on the significance of Ecotect assignment to the studio project and the students' future recommendation.

Figure 6(a), (b), (c), (d) and (e) present the results obtained from the students' feedback survey on the Ecotect assignment on the significance of the assignment to their studio design project. Figure 6(a) shows that all students find the Ecotect exercise is useful to their studio design project, where 63% of them find it either very or extremely useful while only 9% find it slightly useful. Figure 6(b) shows that 99% of the students find that their design skill has improved after completing the Ecotect assignment. 87% of the students find the improvement is either moderately, a lot or a great deal. Meanwhile, Figure 6(c) shows that all students find the Ecotect assignment has made the Environmental Design Course interesting, although only 9% find it slightly interesting. 89% of the students think the Ecotect assignment should remain within the course and only 3% think it should not (Figure 6(d)). Furthermore, 91% stated they are either moderately, very or extremely likely to use the Ecotect software or something similar in their future studio design projects, while 8% stated they are slightly likely to use the software and only 1% stated they are not at all likely to use it (Figure 6(e)).

The students were then asked to add one extra feedback, comment or suggestion for future Environmental Conscious Design assignment. 78% of the students came up with 3 positive comments and 5 constructive suggestions. The most popular suggestion was to introduce or teach the Ecotect software at an earlier stage (Figure 6(f)). 13% of the students suggested to be given more tutorials while 11% of the students suggested that a proper segment should be provided to teach the Ecotect software (Figure 6(f)). The most common comment among the students, with 17%, was that the assignment has helped them in their studio design project. Whereas, 14% of the students find it was a good assignment and that they benefit from it. The result reflects the insight on how Ecotect reflects students' critical understanding of how the buildings work (Charles and Thomas, 2009).

## **Conclusion**

89% of the students agreed with having the Ecotect assignment remain within the Environmental Conscious Design course and only 3% did not agree. Therefore, since the Ecotect assignment is a method of integrating the Environmental Conscious Design course with the studio design project, majority of the students have a good perception towards the integration of course assignment with studio design project. However, only 72% of the students are either moderately or extremely satisfied with the Ecotect assignment given. After analysing the survey results, it is concluded that the lack of satisfaction were mostly due to the improper timing when the assignment was given to the students and also inadequate facilities provided.

The results also show that the Ecotect assignment is significant to the students' studio design project where 91% find it moderately to extremely useful to their studio design work, 87% of the students realised the Ecotect assignment has improved their design skill and 91% of them are likely to use the software in their future design projects.

The students' feedback has shown that the Ecotect assignment should remain within the Environmental Conscious Design course. 91% of the students find the assignment has made the course moderately to extremely interesting while 89% suggest the assignment to be remained within the course.

At the end of the course, most of the posters presented by the students reflect the maturity of the students' critical thinking towards designing an environmental responsive building. This paper contributes to instilling energy conscious design in architecture learning.

### **Future Recommendation**

The 3<sup>rd</sup> year of LAM Part 1 Architecture students was exposed to the environmental software for the first time. In the beginning, it is common and expected to see the students' hesitation and repel towards the Ecotect assignment. Thus, it will be more effective if they could be introduced to such software briefly in the 1<sup>st</sup> year of their architectural studies. The exposure to such software should be repeated regularly throughout the academic years allowing students to develop their environmental analysis simulation skill gradually with increasing difficulties as they get to the higher level of their degree. The environmental software should be introduced during environmental science and system course or even computer skill courses. Since they have inherited Computer Aided Design (CAD) skills, learning Ecotect should not be too difficult for them. Thus, the time given to them to complete the Ecotect assignment was considered sufficient. The only part that had slowed them down was the process of downloading the software and trying to find and download the weather data. Another problem the students faced was the lack of guidance while using the software. It would be ideal to have several trained and skilled tutors who have used the software before to closely guide the students throughout their Ecotect learning experience. It might help the students especially the once who are rather slow in adopting new computer skills. This Ecotect or other relevant environmental software should be utilized more within the Department of Architecture. This Ecotect lesson and assignment should be integrated into other related courses and also studio design projects in order to avoid the lesson from becoming a one off-lesson and experience. Otherwise the skill will become a waste and forgotten.

### **References**

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